

WHAT IS CLAIMED IS:

1. A magnetic random access memory comprising:
  - at least one first wiring and at least one second wiring disposed so as to intersect each other;
  - 5 at least one magnetic tunnel junction element having the tunneling magneto-resistive effect and disposed at the intersection of the first and second wirings, said at least one magnetic tunnel junction element having a structure in which a non-magnetic
  - 10 layer is sandwiched between a fixed layer and a free layer both made of a magnetic film, having a long-side and a short-side of a rectangle, being provided with a spin direction such that the long-side of rectangle is set along the second wiring and that the short-side
  - 15 thereof is set along the first wiring, and along the long-side direction, and having an upper surface which is upwardly convex in the central portion as viewed in the short-side direction, with the long axis as a center of convexity, and a lower surface which is
  - 20 downwardly concave in the central portion as viewed in the short-side direction, with the long axis as a center of concavity;
  - a conductive hard mask formed to cover the upper surface of the magnetic tunnel junction element;
  - 25 conductive contact plugs for electrically connecting the hard mask and the first wiring;
  - a connection wiring to be electrically connected

to the lower surface of the magnetic tunnel junction element; and

an interlayer insulating film provided to be interposed between the connection wiring and the second wiring.

2. The magnetic random access memory according to claim 1, wherein the material of the hard mask is tantalum.

3. The magnetic random access memory according to claim 1, wherein the interlayer insulating film is thicker in the portion facing the lower surface of the magnetic tunnel junction element than in the other portion consecutive thereto.

4. The magnetic random access memory according to claim 1, wherein the width of the second wiring is narrower than the length of the chord between both leading ends of the short-side in the curved state of the magnetic tunnel junction element.

5. The magnetic random access memory according to claim 1, wherein said at least one first wiring and one second wiring include, respectively, a plurality of first wirings and a plurality of second wirings, said at least one magnetic tunnel junction element includes a plurality of magnetic tunnel junction elements disposed in an array form at each intersection of said plurality of first wirings and second wirings, said plurality of first wirings are bit lines for

writing/reading, and said plurality of second wirings are write word lines.

6. The magnetic random access memory according to claim 1, further comprising:

5       a switching transistor for reading, electrically connected to the magnetic tunnel junction element via the connecting wiring.

7. A magnetic random access memory comprising:

10       at least one first wiring and at least one second wiring disposed so as to intersect each other;

15       at least one magnetic tunnel junction element having the tunneling magneto-resistive effect and disposed at the intersection of the first and second wirings, said at least one magnetic tunnel junction element having a structure in which a non-magnetic layer is sandwiched between a fixed layer and a free layer both made of a magnetic film, having a long-side and a short-side of a rectangle, being provided with a spin direction such that the long-side of rectangle  
20       is set along the second wiring and that the short-side thereof is set along the first wiring, and along the long-side direction, and having an upper surface which is downwardly concave in the central portion as viewed in the long-side direction, with the short axis as a  
25       center of concavity, and a lower surface which is upwardly convex in the central portion as viewed in the long-side direction, with the short axis as a center of

convexity;

a conductive hard mask formed to cover the upper surface of the magnetic tunnel junction element;

5       conductive contact plugs for electrically connecting the hard mask and the first wiring;

a connection wiring to be electrically connected to the lower surface of the magnetic tunnel junction element; and

10       an interlayer insulating film provided to be interposed between the connection wiring and the second wiring.

8. The magnetic random access memory according to claim 7, wherein the material of the hard mask is tantalum.

15       9. The magnetic random access memory according to claim 7, wherein the interlayer insulating film is thinner in the portion facing the lower surface of the magnetic tunnel junction element than in the other portion consecutive thereto.

20       10. The magnetic random access memory according to claim 7, wherein the width of the first wiring is wider than the length of the chord between both leading ends of the long-side in the curved state of the magnetic tunnel junction element.

25       11. The magnetic random access memory according to claim 7, wherein said at least one first wiring and one second wiring include, respectively, a plurality of

first wirings and a plurality of wirings, said at least  
one magnetic tunnel junction element includes a  
plurality of magnetic tunnel junction elements disposed  
in an array form at each intersection of said plurality  
5 of first wirings and second wirings, said plurality of  
first wirings are bit lines for writing/reading, and  
said plurality of second wirings are write word lines.

12. The magnetic random access memory according to  
claim 7, further comprising:

10 a switching transistor for reading, electrically  
connected to the magnetic tunnel junction element via  
the connecting wiring.